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New Dynamical-Statistical Techniques for Wind Power Prediction

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The increased use of renewable energy sources, and especially of wind power, has revealed the significance of accurate environmental and wind power predictions over wind farms that critically affect the integration of the produced power in the general grid. This issue is studied in the present paper by means of high resolution physical and statistical models. Two numerical weather prediction (NWP) systems namely SKIRON and RAMS are used to simulate the flow characteristics in selected wind farms in Greece. The NWP model output is post-processed by utilizing Kalman and Kolmogorov statistics in order to remove systematic errors. Modeled wind predictions in combination with available on-site observations are used for estimation of the wind power potential by utilizing a variety of statistical power prediction models based on non-linear and hyperbolic functions. The obtained results reveal the strong dependence of the forecasts uncertainty on the wind variation, the limited influence of previously recorded power values and the advantages that nonlinear – non polynomial functions could have in the successful control of power curve characteristics. This methodology is developed at the framework of the FP7 projects WAUDIT and MARINA PLATFORM.